A6616

LMNED-SP

Lake Pontchartrain, La. & Vic Hurricane Protection Project
17th Street Outfall Canal Butterfly Control Valve Structure
Breakwater Design

C/Des Br
C/F&M Br

C/Des Svcs Br

29 Apr 87
Mr. Stutts/pas/2614

1. Reference is made to my 10 Apr 87 DF, subject as stated above, and to H&H Br CMT 2 dated 21 Apr 87. Copies of the DF's (with enclosures) were hand-carried to your study principals.

2. It is requested that each of your respective offices use the above referenced materials to develop GDM scope designs for the subject breakwater. To minimize delays in furnishing the F&M designs to Des Br, it is requested that F&M Br furnish its input directly to Des with copy furnished to Des Svcs Br.

3. F&M Br should provide its design input to Des Br ASAP but NLT 15 May 87.

4. Since we seek to develop to GDM scope only the most cost-effective plans, it may not be necessary to fully develop all of the alternatives contained in the above referenced DF. Design Branch can, in all probability, make this call once they have received F&M Br's input. We should try to complete the breakwater design and cost estimates NLT 29 May 87.

5. Should you have any questions concerning this request, please contact Mr. Vann Stutts on ext. 2614.

Thomas E. Harrington

Encls
(hand-carried)

THOMAS E. HARRINGTON, JR.
Chief, Design Services Branch

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
LMNED-SP	Lake Pontchartrain, La. & Vic Hurricane Protection Project - 17th Street Outfall Canal Butterfly Control Value Structure Breakwater Design

TO C/H&H Br FROM C/Des Svcs Br DATE 10 Apr 87 CMT 1

Mr. Stutts/pas/2614

1. Reference is made to your 31 Mar 87 DF CMT 4 subject as above, a copy of which is enclosed.

2. The reference DF tabulated several breakwater types along with their associated crown elevations and widths. It is requested that you provide the applicable wave force and pressure diagrams which are required to determine sheet pile penetration and the other structural aspects needed to develop a GDM Scope Design. Also for the double cellular breakwater concept, we will need for you to give us the appropriate spacing between cells so that the greatest attenuation of waves can be achieved. For the rubble structure it will be necessary that you provide a typical design section and the necessary stone gradations and/or armor stone requirements so that we can prepare cost estimates for these plans.

3. The above stated design parameters are needed ASAP but should be provided NLT COB 17 Apr 87.

Encl

THOMAS E. HARRINGTON, JR.
Chief, Design Services Branch

LMNED-HC

TO C/Des Svcs Br FROM C/H&H Br DATE 21 Apr 87 CMT 2

Ms. Hote/beb/2489

As requested in CMT 1 enclosed are wave force diagrams for the narrow cellular sheet pile breakwater (encl 2) and for the double cellular breakwater (encl 3). Spacing for the double cellular breakwater is 85 feet between the walls. The cross-section for the rubble breakwater (encl 4) gives the thickness and gradations for either of the rubble alternatives selected. Note that the rubble structure consists of a shell core, geotechnical fabric, 3 feet of graded riprap and a 6-foot layer of uniform stone. Any questions on this information can be directed to Janis Hote at X2489.

4 Encls
1-3 nc
2-4 added

CECIL W. SOILEAU
Chief, Hydraulics & Hydrologic Branch

LMNED-HC (LMNED-HC/17 Mar 87)
SUBJECT: Lake Pontchartrain, LA & Vic Hurricane Protection Project - 17th Street Outfall Canal - Butterfly Control Value Structure Breakwater Design

TO C/Des Svcs Br FROM C/H&H Br DATE 31 Mar 87 CMT 4
Ms. Hote/beb/2489

For the alternative 2 alignment shown on the enclosure the following physical parameters are required to protect the canal from the SPH stage of 11.5 ft NGVD.

Breakwater Type	Elevation (ft NGVD)	Crown Width (ft)
Narrow Cellular (sheet pile or timber)	15.5	-
Rubble	12.0	25
(impermeable)	14.0	14
Double Cellular (inner)	11.0	-
(outer)	10.5	-

Rubble mound breakwater can be constructed with the steepest stable side slope and have an outer stone thickness of approximately 9 feet of graded stone over a shell core. These design sections and alinements are preliminary and will have to be model-tested to determine their true wave attenuating characteristics.

Encl

for CECIL W. SOILEAU
Chief, Hydrualics & Hydrologic Branch

COMPUTATION SHEET

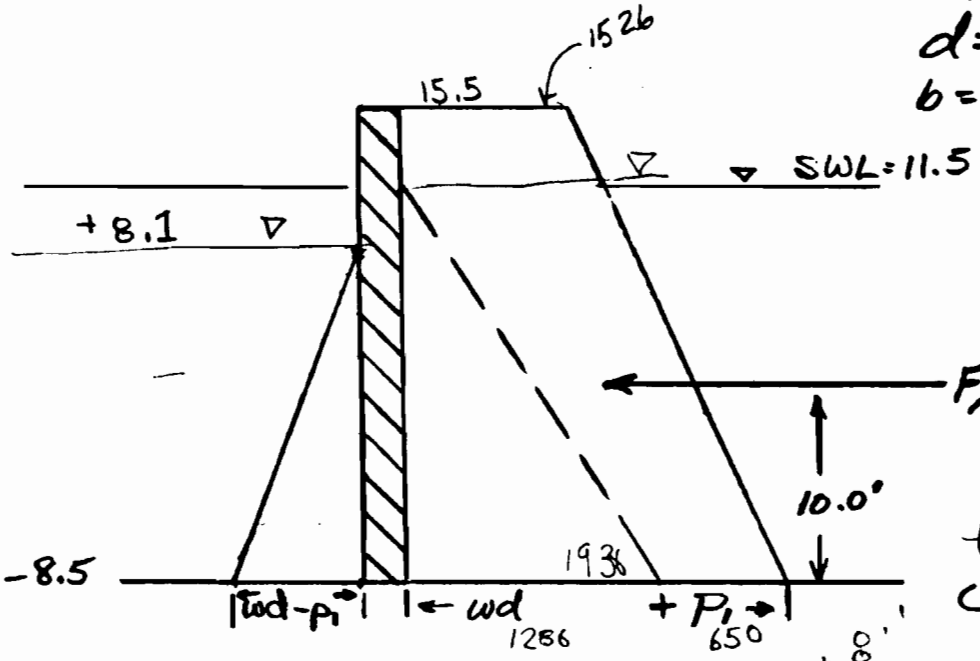
PROJECT L. Pont + Vic - 7.2 St Canal	PAGE 1 OF 1	COMPUTED BY	DATE
SUBJECT Single Narrow Cellular Breakwater @ 15.5		CHECKED BY	DATE

$H_i = 1.67 H_s = 13.0$

$h_o = 9.6$

$d = -8.5 + 11.5 = 20$

$b = -8.5 + 15.5 = 24$



t = trough

c = crest

$y_c = d + h_o + H_i = 20 + 9.6 + 13 = 42.6$

$y_t = d + h_o - H_i = 20 + 9.6 - 13 = 16.6$

$p_1 = wH_i / \cosh(2\pi d/L) = 650$ #/ft

$wd = (64)(20) = 1280$ #/ft² ✓

$P_c = wd + p_1 = 1280 + 650 = 1930$ #/ft²

$P_t = wd - p_1 = 1280 - 650 = 630$ #/ft²

+8'

8.5

8.1

.85

.81 to get wave crest

from El -8.5

⇒ S.W.L

$F_c = F_{wd} \pm F_{wave} = (0.85 + 0.5)\, wd^2 = 34600$ ⇒ WAVE Force outside

$F_t = F_{wd} \mp F_{wave} = (0.5 - 0.34)\, wd^2 = 4100$ ⇒ WAVE TROUGH

For 15.5 ft wall $b/y_c = 24/42.6 = 0.56$

$r_f = .81$ $r_m = 0.60$

$F_c' = r_f F_c = .81(34560) = 28000$

$F_{net} = F_c' - F_t = 28000 - 4100 = \underline{23900}$ #/ft

$M_c = M_{wd} + M_{wave} = (.167 + .67)\, wd^3 = 428400$

$M_t = M_{wd} + M_{wave} = (.167 - .132)\, wd^3 = 17700$

$M_c' = r_m M_c = 0.6(428373) = 257000$

$M_{net} = M_c' + M_t = 257000 - 17700 = \underline{239,300}$ ft#/ft

$X_{net} = \frac{M_{net}}{F_{net}} = \frac{239300}{23900} = 10.0 - 8.5 = +1.5$ ft mgrd

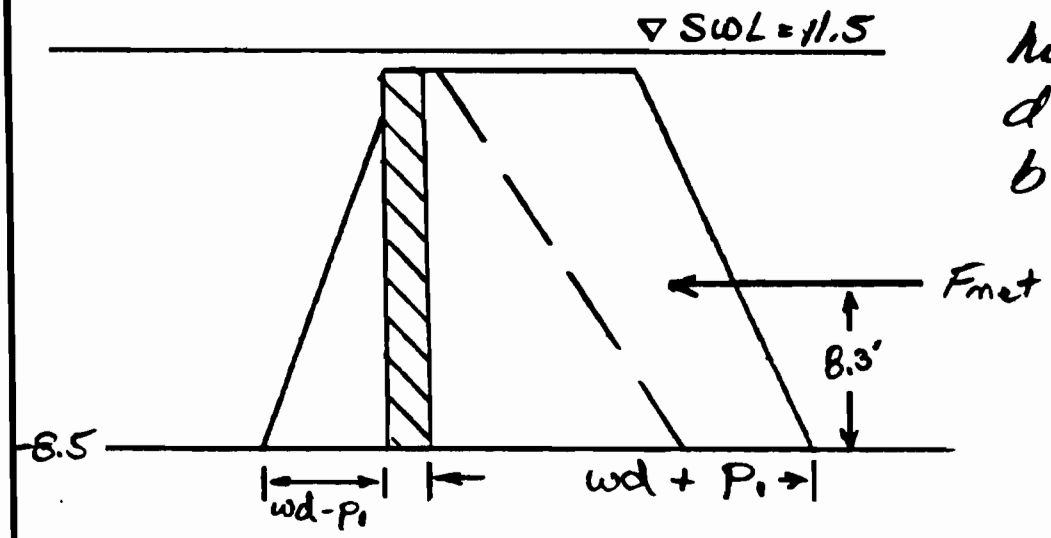
PROJECT L. Port + Vic. 7th St Conn	PAGE 1 OF —	COMPUTED BY	DATE
SUBJECT DOUBLE CELLULAR BREAKWATER (OUTSIDE @ 10.5)		CHECKED BY	DATE

$H_i = 1.67 H_s = 13.0$

$h_o = 9.6$

$d = -8.5 + 11.5 = 20$

$b = -8.5 + 10.5 = 19$



$y_c = d + h_o + H_i = 20 + 9.6 + 13 = 42.6$

$y_t = d + h_o - H_i = 20 + 9.6 - 13 = 16.6$

$wd = (64)(20) = 1280\ \#/ft^2$

$P_1 = w H_i / \cosh(2\pi d/L) = 650\ \#/ft^2$

$P_c = wd + p_1 = 1930\ \#/ft^2$

$P_t = wd - p_1 = 630\ \#/ft^2$

$F_c = F_{wd} + F_{wave} = (0.85 + 0.5) wd^2 = 34600$

$F_t = F_{wd} + F_{wave} = (0.5 - 0.34) wd^2 = 4100$

For 10.5 ft wall $b/y_c = 19/42.6 = 0.45$

$r_f = 0.70 \qquad r_m = 0.43$

$F_c' = r_f F_c = 0.7(34600) = 24200$

$F_{net} = F_c' - F_t = 24200 - 4100 = \underline{20100\ \#/ft}$

$M_c = M_{wd} + M_{wave} = (.167 + .67) wd^3 = 428400$

$M_t = M_{wd} + M_{wave} = (.167 - .132) wd^3 = 17700$

$M_c' = r_m M_c = 0.43(428400) = 184200$

$M_{net} = M_c' - M_t = 184200 - 17700 = \underline{166500\ ft\#/ft}$

$$X_{net} = \frac{M_{net}}{F_{net}} = \frac{166500}{20100} = 8.3 - 8.5 = -0.2\ ft\ mgwd$$

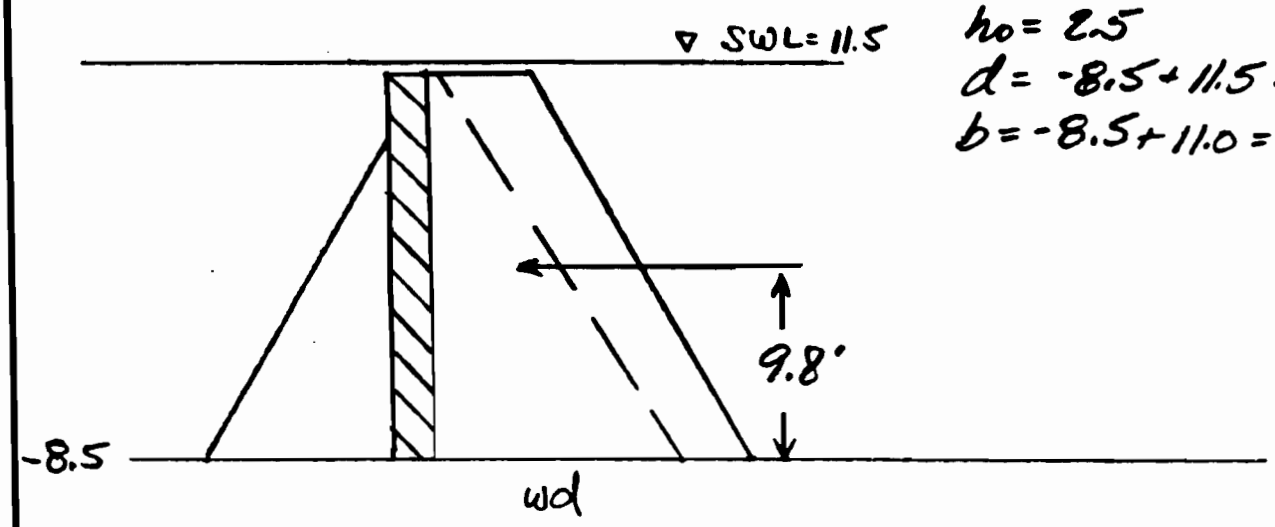
PROJECT L. Port + Vic - 1. th St. Canal	PAGE 2 OF 2	COMPUTED BY	DATE
SUBJECT Double Cellular Breakwater (inside @ 11.0)		CHECKED BY	DATE

$H_i = 1.67 \times 3.9 = 6.5$

$h_o = 2.5$

$d = -8.5 + 11.5 = 20$

$b = -8.5 + 11.0 = 19.5$



$y_c = d + h_o + H_i = 20 + 2.5 + 6.5 = 29.0$

$y_t = d + h_o - H_i = 20 + 2.5 - 6.5 = 16.0$

$wd = 64(20) = 1280$

$p_1 = wH_1/\cosh(2\pi d/L) = 64(6.5)/1.28 = 325$

$p_c = wd + p_1 = 1280 + 325 = 1605\ \#/ft^2$

$p_t = wd - p_1 = 1280 - 325 = 955\ \#/ft^2$

$F_c = F_{wd} + F_{wave} = (0.5 + .34)wd^2 = 21500$

$F_t = F_{wd} + F_{wave} = (0.5 - .22)wd^2 = 7100$

For 11.0 ft wall $b/y_c = 19.5/29 = 0.67$

$r_f = 0.89 \qquad r_m = 0.75$

$F_c' = r_f F_c = 0.89(21500) = 19100$

$F_{net} = F_c' - F_t = 19100 - 7100 = \underline{12000\ \#/ft}$

$M_c = M_{wd} + M_{wave} = (.167 + .22)wd^3 = 198000$

$M_t = M_{wd} + M_{wave} = (.167 - .106)wd^3 = 31100$

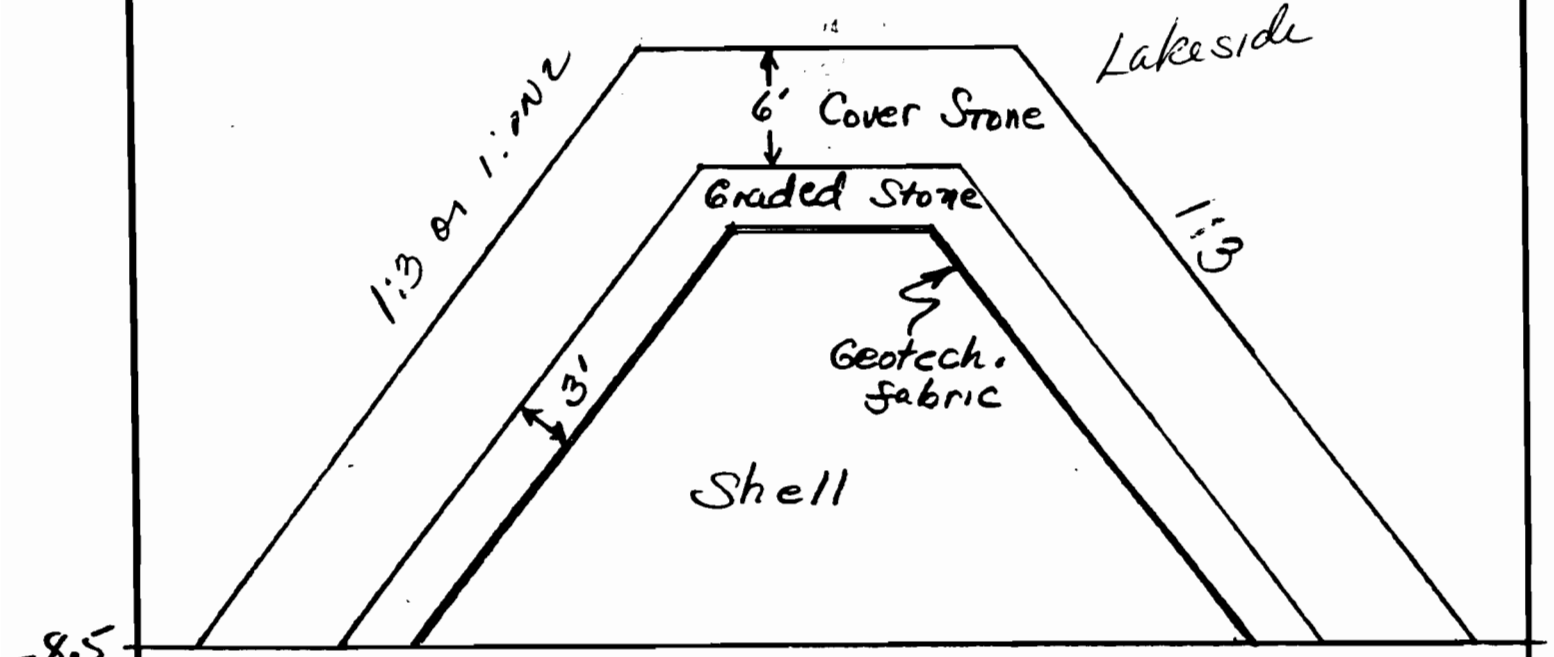
$M_c' = r_m M_c = 0.75(198000) = 148500$

$M_{net} = M_c' - M_t = 148500 - 31100 = \underline{117400\ ft\#/ft}$

$$X_{net} = \frac{M_{net}}{F_{net}} = \frac{117400}{12000} = 9.8 - 8.5 = +1.3\ ft\ mwd$$

COMPUTATION SHEET

PROJECT L. Pont - 17th St Canal	PAGE 1 OF 1	COMPUTED BY	DATE
SUBJECT TYPICAL RUBBLE BREAKWATER		CHECKED BY	DATE



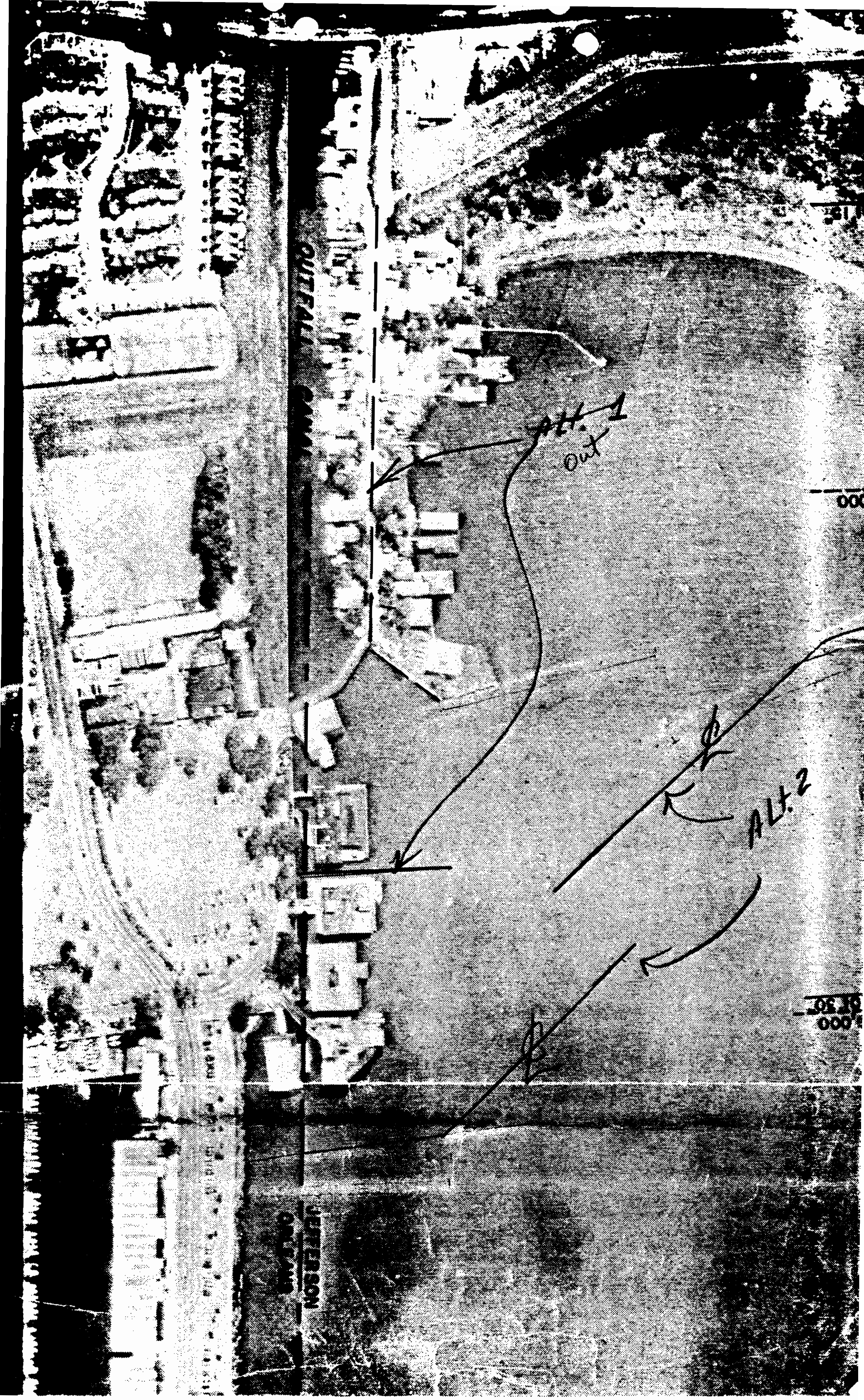
Cover Stone $W = 3900\#$

$W_{upper} = 4900\#$

$W_{lower} = 2900\#$

Graded Stone

Percent Lighter by Weight	Weight lbs.
100	2200 - 900
50	930 - 440
15	460 - 130


OUTFALL
Alt. 1
Out
Alt. 2
JEFFERSON
ORLEANS